

**Branch, E.H.I. (1997). Biological monitoring and health interview study among residents of an area with pentachlorophenol contaminated groundwater, California Department of Health Services.**

**EXECUTIVE SUMMARY**

In 1981, pentachlorophenol (PCP) contamination in 50 domestic wells in an area south of Oroville and near a wood treatment facility (the facility is referred herein as the SOWTF) using PCP, was reported as 1-50 ug/L, many orders of magnitude above background levels. PCP is a known systemic poison. In late 1985 and early 1986 the California Department of Health Services (CDHS) conducted a health interview, water, and biological monitoring study of 32 households with private wells near the SOWTF, herein referred to as the “exposure area households.” Control households were selected from Honcut, CA. Urine and water samples collected in December of 1985 and early 1986, prior to the connection of the homes near the SOWTF to the non-contaminated municipal drinking water system. Health interviews were conducted between January and April, 1986. In addition, historical PCP water monitoring conducted by the owners of the SOWTF, of wells connected to households in the study was reviewed.

The analysis of the 1986 health interviews was considerably delayed by the large epidemiological and environmental studies conducted following a large PCP fire in 1987 at the SOWTF facility. Other CDHS studies, of other areas of California also took precedence. More recently, a federal agency, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), has requested a report of the 1985-1986 interview and sampling study for inclusion in a health assessment of the SOWTF petitioned by private citizens.

The analysis of the 1985-1986 symptom interviews, biological monitoring, and tap water measurements and the historical (Jan 1984-April 1986) well water measurements finds:

- ! Although 86 and 92 percent of eligible exposure area and control households agreed to participate, fewer, 67 and 86 percent respectively, participated in the questionnaire. Lower percentages, 62 and 68 in the exposure and control area households, respectively, participated in both urine sampling and the questionnaire interviews.
- ! Of exposure area adults, 27 percent reported usually drinking tap water in spite of

the availability of bottled water.

- ! Historical measurements indicate that exposure area household wells occasionally exceeded the World health Organization's recommended level of 10 ug PCP/L or part per billion (ppb), and indicate sporadic swings in measurements, e.g., from 210 ppb to less than 0.1 ppb back to 56 ppb. Of the exposure area household well measurements between January 1984 and the end of study sample collection April, 1985, excursions up to 640 ppb were reported, with an average of 11.4 ug/L. However, consistent temporal sampling across study household wells was not conducted and is not adequate to calculate mean or maximum PCP values for each household or to be used in conjunction with questionnaire data. The historical well water results do, however, provide general evidence that domestic well water in the exposure study area was contaminated at levels above background, i.e., typical values in US drinking water (0.008-0.07 ppb).
- ! PCP values in study tap water samples, collected at the time of urine sample collection, from the exposure area households were at background (mean=0.032 ppb) and were not different than control tap water samples (mean=0.035 ppb).
- ! Urine PCP values were the same in the exposed (mean=2.9 ug/g creatinine) and control population (mean=3.6 ug/g creatinine) and were no different from that reported for the U.S. general population (estimated geometric mean=6.3 ug/L). However, the half-life of PCP in urine is short (about 2 weeks) and individuals may have been exposed prior to testing.
- ! Frequent and infrequent tap water odor was reported more frequently among the exposure area residents (57%) than the controls (12%). Thirteen exposure area residents characterized water odors as chemically-related e.g., "solvent", or gas or fuel-like while no control area residents characterized the water using these descriptions. Fourteen exposure area residents also characterized water odor as rotten/sulfur like or as unknown, e.g., "bad", while 6 control residents characterized water odor with these descriptions. All of these odors may be considered to be consistent with the "pungent" odor of PCP.
- ! Fifty-seven percent of the exposure area adults and 25 percent of the controls reported that their health had changed for the worse since moving to their present address. Other measures of overall health status, e.g., hospital admissions, did not indicate poorer health in the exposure area.
- ! Among the exposed area adults all nineteen symptoms on the questionnaire were more frequently reported to have gotten worse since moving to the area compared to the control group. The most frequently reported symptoms among the exposed group were headache (45%) and skin rash/irritation (45%).
- ! A comparison of odds ratios (OR) adjusted for the demographic differences or

confounders (age, gender, smoking history, length of residence in the area, and use of wood preservatives) between the exposed and control populations revealed significantly elevated reporting of nine symptoms: fever (OR=11.7, 95% confidence interval (CI)=1.1-1.25), sore throat (OR=9.1, CI=1.3-62), fatigue (OR=7.5, CI=1.9-30), nausea (OR=6.0, CI=1.2-29), nervousness (OR=5.6, CI=1.5-20), frequent or severe headache (OR=4.5, CI=1.3-15), muscle aches (OR=4.4, CI=1.1-18), dizziness (OR=4.4, CI=1.3-15), skin rash or irritations (OR=3.2, CI=1.0-9.5).

- ! Odor was considered as a potential surrogate of exposure. Similar multiple logistic regression analysis indicated that twelve symptoms, including eight of the above, were more strongly associated with frequent water odor than with exposure area and that exposure area has little to add to the prediction of symptoms above and beyond what is contributed by odor. The exceptions to this are unexplained fever and nervousness, which are not significantly associated with water odor but are significantly associated with exposure area.

This study was conducted, in part, because members of the community were reporting elevated body burdens of PCP. Although the results only represent about a two-week exposure period, body burdens were not elevated at the time of testing.

Living in the exposure area is strongly associated with self-reported symptoms. To evaluate whether the reported symptoms may be linked to PCP exposure several factors were considered. First, the evidence of exposure to PCP was considered. Clearly, water and biological levels at the time of the study were not elevated. The reported symptoms, however, are more chronic than the PCP biological half-life, particularly given the phrasing of the questions, Has this symptom gotten worse since you moved here? Thus, the urine and tap water sampled do not reflect the exposure period that may be associated with symptoms. Unfortunately, adequate historical sampling to allow the association between historical exposure to PCP and symptom reporting to be examined, was not conducted. If water odor is considered as a surrogate for exposure, the strong association with water odor for most of these symptoms could be considered to provide modest support for PCP exposure as an explanation. However, alternative explanations, such as odors, not contaminants, making people sick, operated to some extent, as a few of the controls reporting frequent and infrequent water odors also reported symptoms. The association with water odor does not provide a direct link between PCP exposure and symptoms.

Without a direct link between PCP levels in tap water and symptoms, PCP exposure is simply one, of several, possible explanations for the elevated reporting of symptoms. Other explanations include recall bias, other chemical exposures, other exposures, e.g.,

infectious agents, and other differences between the exposed and control populations, e.g., the stress of living in a contaminated area. The small number of people reporting some symptoms adds to the likelihood of the possibility of these other explanations. Hence, the scientific weight of these results, in isolation, is small: the results provide little support or clarity as to whether PCP in drinking water caused or can cause these symptoms.

There is a broader toxicological and epidemiological literature which documents the symptoms, reported elevated here, at PCP urine concentrations which approximately equal that estimated from chronic ingestion of PCP levels detected in historical monitoring of exposure area household wells. These other studies add additional scientific weight to the elevated reporting of symptoms but, again, do not provide a direct link between PCP exposure and the symptoms reported here. The toxicological and epidemiological literature suggests, but does not prove, that the self-reported symptoms reported here may be associated with PCP exposures.

The findings of the broader toxicological and epidemiological literature, in isolation, justify protective public health action for those residents in the south or Oroville area with contaminated drinking water wells: estimate exposures for which symptoms are documents in other studies to occur should be avoided. Stipulation of potential long-term health impacts from the SOWTF and of necessary protective public health actions was the intent of the petitioned ATSDR health assessment. The draft assessment recommended: monitoring of groundwater, community health education; and a survey of land owners near the SOWTF to determine current land and water usage. Additional steps could include education of health care providers on the possible association of symptoms and PCP exposure and the necessity of avoiding exposure to well water. However, these recommendations should be made in context of current conditions of the wood treatment facility, including current well water PCP levels. US EPA has indicated that PCP levels have declined with time. CDHS awaits ATSDR's final health assessment for a determination of whether these recommendations are currently appropriate.

Finally, residents near other NPL sites with PCP groundwater contamination may pose a large exposed population. A final recommendation is for ATSDR to review the number of NPL sites with drinking water PCP contamination, the extent of the contamination at these sites, to evaluate the evidence presented herein, and to consider whether additional studies are scientifically appropriate.